E 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RTID 0648-XB015

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Geophysical Survey in the Arctic Ocean

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from the University of Alaska Geophysics Institute (UAGI) for authorization to take marine mammals incidental to a geophysical survey in the Arctic Ocean. The proposed survey would be funded by the National Science Foundation (NSF). Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time, one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in **Request for Public Comments** at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than [*insert date 30 days after date of publication in the FEDERAL REGISTER*].

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service and should be submitted via email to *ITP.Corcoran@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record and will generally be posted online at *www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act* without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Kim Corcoran, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*. In case of problems accessing these documents, or for anyone who is unable to comment via electronic mail, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the "take" of marine mammals, with certain exceptions. sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq*.) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is

limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stocks for taking for certain subsistence uses (referred to in shorthand as "mitigation"); and requirements pertaining to the monitoring and reporting of the takings.

The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an IHA) with respect to potential impacts on the human environment.

NMFS plans to adopt the NSF's Environmental Assessment (EA), as we have preliminarily determined that it includes adequate information analyzing the effects on the human environment of issuing the IHA. NSF's EA is available at *www.nsf.gov/geo/oce/envcomp/*.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On February 12, 2021, NMFS received a request from UAGI for an IHA to take marine mammals incidental to a geophysical survey in the Arctic Ocean. The application was deemed adequate and complete on April 6, 2021. UAGI's request is for take of 13 species of marine mammals, by Level B harassment only. No Level A harassment is anticipated. Neither UAGI nor NMFS expects serious injury or mortality to result from this activity. Therefore, an IHA is appropriate.

Description of Proposed Activity

Overview

Researchers at UAGI, with funding from NSF, propose to conduct a seismic survey from the Research Vessel (R/V) *Sikuliaq* in the Arctic Ocean to document the structure and stratigraphy of the Chukchi Borderland and adjacent Canada basin. The proposed activity is planned to take place in late summer 2021 (August/September) with a total of 30 days of data acquisition. The survey would include both high energy and low energy components. High-energy ocean bottom seismometer (OBS) refraction surveys will use a 6-airgun, 3120 cubic inches (in^3) array and consist of ~12 percent of total survey effort (henceforth referred to as high-energy survey). Low-energy multi-channel seismic (MCS) reflection surveys will use a 2-airgun array with a total discharge volume of 1040 in^3 and consist of ~88 percent of total survey effort (henceforth referred to as low-energy survey).

Dates and Duration

The proposed activity will occur between August and September, 2021. The activity is planned to occur for 45 days total, with ~30 days dedicated to seismic data acquisition (with 24-hours a day operations), ~8 days devoted to transit and 7 days used for equipment deployment and recovery.

Specific Geographic Region

The proposed surveys would occur within ~73.5–81.0°N, ~139.5–168°W (≥300 kilometer (km) north of Utqiaġvik). Representative survey track lines can be seen in Figure 1. Some deviation in track lines, including the order of survey operations, could be necessary for reasons such as science drivers, poor data quality, inclement weather, or mechanical issues with the research vessel and/or equipment. Thus, the track lines could occur anywhere within the coordinates noted above and within the study area. Four percent of the surveys will occur within the U.S. Exclusive Economic Zone (EEZ) with the remaining part of the survey occurring beyond the EEZ. The activity will take place in depths ranging from 200-4000 meters (m). The R/V *Sikuliaq* would likely leave and return to Nome, AK.

The low-energy survey activity will begin ~300 km from the Alaskan coastline (North of Utqiagvik) and extend ~800 km north from the initial survey site (*i.e.*, the survey would occur ~300-1100 km from the Alaska coastline). The high-energy survey activity will only occur ~530 km from the coastline and occur only in the northeastern part of the survey area (See Figure 1). Eighty percent of the total survey will occur in deep waters (>1000m) with the remainder of the survey occurring in intermediate depth waters (100-1000m); no surveying will occur in waters <100 m deep. All high-energy surveys (680 km total) will occur in deep waters, while 67 percent of low-energy surveys will occur in deep waters (3981 km) with the remainder occurring in intermediate depth waters (1189 km or 23 percent).

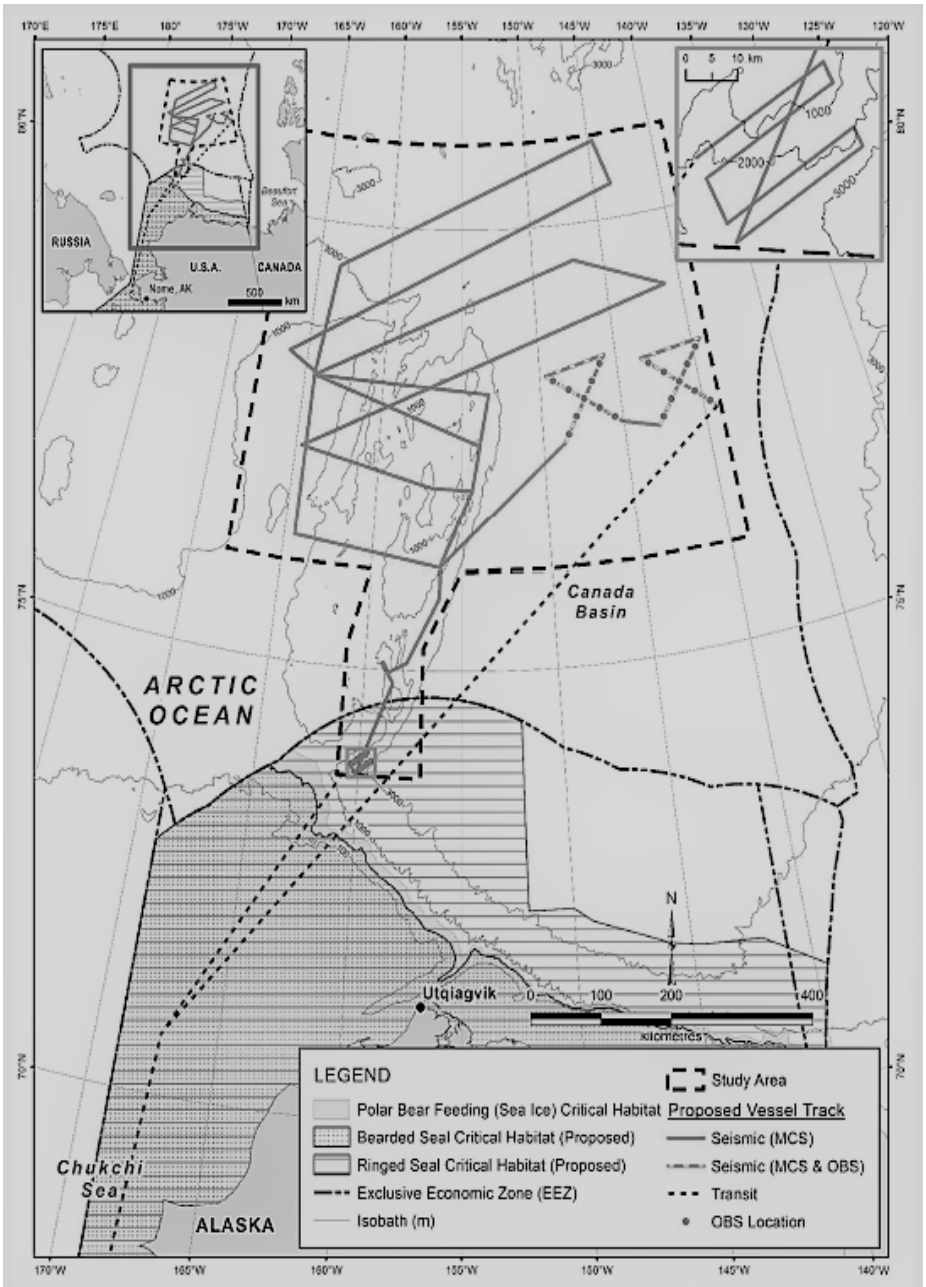

FIGURE 1. Location of the proposed seismic surveys and OBS deployments in the Arctic Ocean and marine mammal critical habitat in the U.S.

Figure 1. Location of the proposed seismic surveys and OBS deployments in the Arctic Ocean and Endangered Species Act critical habitat in the U.S.

Detailed Description of Specific Activity

The proposed study would use low-energy two-dimensional (2-D) seismic surveying to document the history, structure, and stratigraphy of the Chukchi Borderland

and adjacent Canada Basin, and use high-energy seismic refraction data in the Canada Basin to characterize the deep crustal structure associated with an extinct mid-ocean ridge in the central basin.

The procedures to be used for the proposed marine geophysical survey would include conventional seismic methodology. The survey would involve one source vessel, R/V *Sikuliaq*, which has a cruising speed of 10 knots (kt), and would tow an array of 6 airguns (520 in^3 (8521.27 cm^3) each) and a total possible discharge volume of ~3120 in^3 during high-energy surveys. During low-energy reflection surveys, a 2-airgun array (at 520 in^3 each) would be used with a total discharge volume of 1040 in^3. Both arrays will be towed at a depth of 9m. During low-energy surveys (~88 percent of total line km), a 1–3 km long hydrophone streamer (depending on ice conditions) would be employed as the receiving system, and high-energy surveys (~12 percent of total line km) would employ nine OBSs as the receiving system. As the airgun arrays are towed along the survey lines, the OBSs would receive and store the returning acoustic signals internally for later analysis, and the hydrophone streamer would transfer the data to the on-board processing system. The airguns would fire at a shot interval of 35 m (~15 seconds (s)) during the low-energy surveys and at a 139-m (~60 s) interval during the high-energy refraction surveys. The airguns would operate at a firing pressure of 2,540 pounds per square inch (psi).

In addition to the aforementioned planned survey lines, some lines, as indicated in Figure 1, will be surveyed twice: once for low-energy reflection and again for high energy refraction. These surveys would take place near the end of operations in the northeastern part of the survey area (Fig. 1); however, the location of these surveys could shift slightly to ensure one survey occurs over the extinct ridge axis and the other on hyper-extended continental crust. A total of nine OBSs would be deployed twice for a total of 18 deployment sites during high energy survey effort. Nine OBSs would be

deployed during low-energy surveying, then high-energy refraction data would be acquired along these same lines, followed by retrieval of the OBS equipment, before R/V *Sikuliaq* would travel to the next site to deploy all nine OBSs again. Approximately 5850 total line km would be surveyed, including 5170 km of low-energy surveys, and 680 km of high-energy surveys. There could be additional seismic operations associated with turns, airgun testing, and repeat coverage of any areas where initial data quality is sub-standard. As a result, a 25 percent buffer has been added in the form of operational days, which is equivalent to adding 25 percent to the proposed line km to be surveyed. Most of the survey (80 percent) would occur in deep water (>1000 m), and 20 percent would occur in intermediate water (100–1000 m deep); there would be no effort in shallow water <100 m deep.

In addition to the operations of the airgun array, a multibeam echosounder (MBES), a sub-bottom profiler (SBP), and an Acoustic Doppler Current Profiler (ADCP) would be operated from R/V *Sikuliaq* continuously during the seismic surveys, but not during transit to and from the survey area. Take of marine mammals is not expected to occur incidental to use of the MBES, SBP, or ADCP because they will be operated only during seismic acquisition, and it is assumed that, during simultaneous operations of the airgun array and the other sources, any marine mammals close enough to be affected by the MBES, SBP, and ADCP would already be affected by the airguns. However, whether or not the airguns are operating simultaneously with the other sources, given their characteristics (*e.g.*, narrow downward-directed beam), marine mammals would experience no more than one or two brief ping exposures, if any exposure were to occur.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see **Proposed Mitigation** and **Proposed Monitoring and Reporting**).

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS's website (*https://www.fisheries.noaa.gov/find-species)*. Additional information may be found in the Aerial Survey of Arctic Marine Mammals (ASAMM) reports, which are available online at *https://www.fisheries.noaa.gov/alaska/marine-mammal-protection/aerial-surveys-arctic-marine-mammals.*

Table 1 lists all species or stocks for which take is expected and proposed to be authorized for this action, and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2020). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For most species, stock abundance estimates are based on

sightings within the U.S. EEZ, however for some species, this geographic area may extend beyond U.S. waters. Other species may use survey abundance estimates. Survey abundance (as compared to stock or species abundance) is the total number of individuals estimated within the survey area, which may or may not align completely with a stock's geographic range as defined in the SARs. These surveys may also extend beyond U.S. waters. In this case, the proposed survey area outside of the U.S. EEZ does not necessarily overlap with the ranges for stocks managed by NMFS. However, we assume that individuals of these species that may be encountered during the survey would be part of those stocks. Additionally, six species listed in Table 1 indicate Unknown abundance estimates. This may be due to outdated data and population estimates or data is not representative of the entire stock.

All managed stocks in this region are assessed in NMFS's U.S. Alaska and Pacific SARs (*e.g.*, Muto *et al.*, 2020, Carretta *et al.*, 2020). All values presented in Table 1 are the most recent available at the time of publication and are available in the 2019 SARs (Muto *et al.*, 2020, Carretta *et al.*, 2020) and draft 2020 SARs (available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

In addition, the Pacific walrus (*Odobenus rosmarus divergens)* and the Polar bear (*Ursus maritimus)* may be found in the Arctic. However, Pacific walruses and Polar bears are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Table 1. **Marine Mammals Expected to Occur in the Survey Area**.

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						

Gray whale	*Eschrichtius robustus*	Eastern N Pacific	-, -, N	26,960 (0.05, 25,849, 2016)	801	131
Family Balaenidae						
Bowhead whale	*Balaena mysticetus*	Western Arctic	E, D, Y	16,820 (0.052,16,100,2011)	161	56
Family Balaenopteridae (rorquals)						
Fin whale	*Balaenoptera physalus*	Northeast Pacific[4]*	E, D, Y	Unknown	UND	0.6
Humpback whale	*Megaptera novaeangliae*	Western N Pacific*	E, D, Y	1,107 (0.3, 865, 2006)	3	2.8
Minke whale	*Balaenoptera acutorostrata*	Alaska[4]*	-, -, N	Unknown	UND	0
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae						
Beluga whale	*Delphinapterus leucas*	Beaufort Sea[4]	-, -, N	39,258 (0.229, N/A. 1992)	UND	102
		Eastern Chukchi	-, -, N	13,305 (0.51, 8,875, 2017)	178	55
Killer whale	*Orcinus orca*	Alaska resident	-, -, N	2,347 c (N/A, 2347, 2012)	24	1
Narwhal	*Monodon Monoceros*	Unidentified[4]*	-, -, N	Unknown	UND	0
Family Phocoenidae (porpoises)						
Harbor Porpoise	*Phocoena phocoena*	Bering Sea[4]*	-, -, Y	Unknown	UND	0.4
Order Carnivora – Superfamily Pinnipedia						
Family Phocidae (earless seals)						
Bearded Seal	*Erignathus barbatus*	Beringia[4]*	T, D, Y	Unknown	UND	6,709
Ribbon Seal	*Histriophoca fasciata*	Unidentified*	-, -, N	184,687 (see SAR, 163,086, 2013)	9785	163
Ringed Seal	*Pusa hispida*	Arctic	T, D, Y	Unknown	5100	6459
Spotted Seal	*Phoca largha*	Bering	-, -, N	461,625 (see SAR, 423,237, 2013)	25,394	5,254

* Stocks marked with an asterisk are addressed in further detail in the text below.

1 - Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

2- NMFS marine mammal stock assessment reports online at: www.nmfs.noaa.gov/pr/sars/. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable. For most stocks of killer whales, the abundance values represent direct counts of individually identifiable animals; therefore there is only a single abundance estimate with no associated CV. For certain stocks of pinnipeds, abundance estimates are based upon observations of animals (often pups) ashore multiplied by some correction factor derived from knowledge of the species' (or similar species') life history to arrive at a best abundance estimate; therefore, there is no associated CV. In these cases, the minimum abundance may represent actual counts of all animals ashore.

3 - These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, ship strike).
4- Abundance estimates for these stocks are not considered current. PBR is therefore considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates, as these present the best available information for use in this document.

As indicated above, all 13 species (with 14 managed stocks) in Table 1 could temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur, and we have proposed authorizing it. All species that could potentially occur in the proposed survey areas are included in Table 4 of the IHA application.

Beluga whales and ringed seals are the marine mammal species most likely to be encountered during this survey, with bowhead whales and bearded seals also having a higher likelihood of co-occuring in the survey area over the other proposed species in Table 1. However, these four species (beluga whales, ringed seals, bowhead whales and bearded seals) are most common within 100 km of shore, whereas the proposed survey would occur no closer than 300 km from shore, with most effort further north. Thus, despite their prevalence in Arctic waters north of Alaska, we expect there to be a low likelihood of encountering even beluga whales, ringed seals, bowhead whales and bearded seals during the proposed survey given the proposed activity's distance from shore.

Humpbacks, fin and minke whales have rarely been observed as far north in the Arctic Ocean as the planned survey location but have been spotted on rare occasions in areas coinciding with the lower latitudes of the proposed survey area during previous aerial surveys. Similar sightings during the proposed activity are expected to be limited during the proposed survey as the majority of the proposed survey area occurs in higher latitudes and outside typical migratory patterns for these species (Brueggeman, 2009; Haley *et al*., 2010; Clarke *et al*., 2011; Schuck *et al*., 2017). However, Brower *et al*., (2018) suggest that sightings of these sub-Arctic species are increasing in the eastern Chukchi Sea as of recent years due to climate change. Killer whales, gray whales, humpback whales, fin whales, minke whales and harbor porpoises are minimally sighted

in the Chukchi Sea based on ASAMM data and are primarily coastal species, however recent monitoring activities in the Chukchi and Beaufort seas during industry seismic surveys also suggests that some of these species may be increasing in numbers in the Arctic but are still expected to be south of the proposed survey area (Funk *et al*., 2010). Additionally, there are scattered records of narwhal in Alaskan waters, where the species is considered to be extralimital. However, we do not expect the species to be encountered far north in the proposed survey area (Reeves *et al*., 2002). Although we do not expect the proposed survey area to coincide with expected ranges of the species described in this paragraph, takes equivalent to the average group size for the species are proposed for authorization at the applicant's request as a precaution due to the potential that they could be encountered.

Prior to 2016, humpback whales were listed under the ESA as an endangered species worldwide. Following a 2015 global status review (Bettridge *et al.*, 2015), NMFS delineated 14 distinct population segments (DPS) with different listing statuses (81 FR 62259; September 8, 2016) pursuant to the ESA. The DPSs that occur in U.S. waters do not necessarily equate to the existing stocks designated under the MMPA.

Within Alaska waters, four humpback whale DPSs may occur: the Western North Pacific (WNP) DPS (endangered), Hawaii DPS (not listed), Mexico DPS (threatened), and Central America DPS (endangered). According to Wade (2017), in the Bering, Chukchi, and Beaufort Seas, encountered whales are most likely to be from the Hawaii DPS (86.8 percent), but could be from the Mexico DPS (11.0 percent) or WNP DPS (2.1 percent). Note that these probabilities reflect the upper limit of the 95 percent confidence interval of the probability of occurrence; therefore, numbers may not sum to 100 percent for a given area. Because this project occurs north of the Chukchi and Beaufort Sea and in the Arctic, we hypothesize that the Western North Pacific Stock of humpback whales

will overlap with the proposed survey area, and thus include animals from the WNP DPS, Hawaii DPS and Mexico DPS as previously mentioned.

At this time, there is no comprehensive abundance estimate available in the SARs for the Alaska stock of minke whales. However, the International Whaling Commission (IWC) reports an abundance estimate of 20,000 minke whales in the North Pacific (North West Pacific and Okhotsk Sea) (2003), which is the figure used for analysis. This estimate encompasses the distribution of minke whales throughout the North Pacfic extending to 80 degrees North. 20,000 is the most recent abundance estimate available for minke whales in the north pacific provided by IWC. In 2017, the IWC Scientific Committee established a new group to review all abundance estimates and ensure quality and consistency across estimates used by IWC. According to the IWC website and the criteria established by this group, the 20,000 whale estimate in the North Pacific from 2003 is considered to be the 'best' estimate at this time.

Similarly, although a comprehensive abundance estimate is not available for the northeast Pacific stock of fin whales, provisional estimates representing portions of the range are available. The same 2010 survey of the eastern Bering sea shelf provided an estimate of 1,061 (CV = 0.38) fin whales (Friday *et al.*, 2013). The estimate is not corrected for missed animals, but is expected to be robust as previous studies have shown that only small correction factors are needed for fin whales (Barlow, 1995). Zerbini *et al.,* (2006) produced an estimate of 1,652 (95 percent Confidence Interval (CI): 1,142-2,389) fin whales for the area described above.

Narwhals are found year-round in the Arctic but rarely occur in the western Arctic, in areas including the Bering, Chukchi, and Beaufort Seas (COSEWIC, 2004). There are three populations of narwhals recognized internationally based on geographic separation, which include the Baffin Bay population, Hudson Bay population, and the East Greenland population. Currently, very little is known about these populations. The

primary source for data and knowledge of narwhals in Alaska waters is local observations and traditional ecological knowledge dating back to the 1800s (Noogwook *et al*., 2007). Individual sightings have occurred in Russian waters of the northern Chukchi Sea (Yablokov and Bel'kovich, 1968; Reeves and Tracey, 1980). Additionally, Alaska Native hunters recorded seven sightings of narwhals between 1989 and 2008, four of which consisted of mixed groups of narwhals and belugas (George and Suydam, unpublished manuscript). Records of narwhals in the Beaufort, Chukchi, and Bering Seas are hypothesized to be whales from the Baffin Bay population, migrating into the Canadian Arctic as ice conditions permit (COSEWIC, 2004). At this time, there are no reliable estimates of abundance for narwhals in Alaskan waters.

Based on previous industry-sponsored monitoring in the Beaufort Sea, harbor porpoises regularly occur in both the Chukchi and Beaufort Seas (Funk *et al*., 2011). They have been sighted during several seismic surveys, both nearshore and offshore, between July and November (Funk *et al*., 2010, 2011; Reiser *et al*., 2011; Aerts *et al*., 2013). After gray whales and bowhead whales, they are the most frequently sighted cetacean in the Chukchi Sea (Funk *et al*., 2011; Reiser *et al*., 2011). Shipboard visual line-transect surveys occurred biannually from 1999 to 2010, resulting in harbor porpoise abundance estimates for each survey. These surveys demonstrate the distribution of harbor porpoises throughout the Chukchi and Beaufort Seas but are not reliable for estimating abundance estimates in this region.

Bearded seals are widely distributed throughout the summer and fall, following ice coverage northward, while juvenile seals remain near the coasts of the Bering and Chukchi Seas (Burns, 1967, 1981; Heptner *et al*., 1976; Nelson, 1981; Cameron *et al*., 2018). At this time, there is no reliable population estimate available for the entire Alaska stock of bearded seals. Recent aerial abundance surveys (Conn *et al*., 2014) used a sub-sample of data collected in the U.S. portion of the Bering Sea to calculate a partial

abundance estimate of 301,836 seals (95 percent CI: 238,195-371,147). Future studies plan to combine spring survey results of the Chukchi Sea and Beaufort Sea.

Similarly, ringed seals also lack a reliable population estimate for the entire stock. Conn *et al*., (2014) calculated an abundance estimate of 171,418 ringed seals (95 percent CI: 141,588-201,090) using a sub-sample of data collected from the U.S. portion of the Bering Sea in 2012. Researchers plan to combine these results with those from spring surveys of the Chukchi and Beaufort Seas once complete. During the summer months, ringed seals forage along ice edges or in open water areas of high productivity and have been observed in the northern Beaufort Sea during summer months (Harwood and Stirling, 1992; Freitas *et al*., 2008; Kelly *et al*., 2010b; Harwood *et al*., 2015). This open water movement becomes limited with the onset of ice in the fall forcing the seals to move west and south as ice packs advance, dispersing the animals throughout the Chukchi and Bering Seas, with only a portion remaining in the Beaufort Sea (Frost and Lowry, 1984; Crawford *et al*., 2012; Harwood *et al*., 2012).

In addition to ringed and bearded seals, other pinniped species that could be encountered during the proposed survey include the ribbon seal and spotted seal. The ribbon seal is uncommon in the Chukchi Sea, and there are few sightings in the Beaufort Sea. From late March to early May, ribbon seals inhabit the Bering Sea ice front. They are most abundant in the northern part of the ice front in the central and western parts of the Bering Sea. As the ice recedes in May to mid-July, the seals move farther north in the Bering Sea, where they haul out on the receding ice edge and remnant ice. Spotted seals are more abundant in the Chukchi Sea and occur in small numbers in the Beaufort Sea. As the ice melts, seals become more concentrated, with part of the Bering Sea population moving to the Bering Strait and the southern part of the Chukchi Sea. The distribution of spotted seals is seasonally related to specific life-history events that can be broadly divided into two periods: late-fall through spring, when whelping, nursing, breeding, and

molting occur in association with the presence of sea ice on which the seals haul out, and summer through fall when seasonal sea ice has melted and most spotted seals use land for hauling out. Satellite-tagging studies showed that seals tagged in the northeastern Chukchi Sea moved south in October and passed through the Bering Strait in November. Seals overwintered in the Bering Sea along the ice edge and made east-west movements along the edge. In summer and fall, spotted seals use coastal haul-out sites regularly and may be found as far north as 69-72º N in the Chukchi and Beaufort seas. Neither of these species would likely be encountered during the proposed activity other than perhaps during transit periods to or from the survey area. Although their encounters this far north in the Arctic are rare, authorization of take has been proposed at the request of the applicant. Clarke *et al.,* (2015) described Biological Important Areas (BIAs) for cetaceans in the Arctic. BIAs were delineated for two baleen whale species, bowhead whales and gray whales, and one toothed whale, the beluga whale. The proposed UAGI survey areas do not coincide with any of the three Arctic BIAs.

Unusual Mortality Events (UME)

A UME is defined under the MMPA as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response." For more information on UMEs, please visit: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events*. Currently recognized UMEs in Alaska involving species under NMFS' jurisdiction include those affecting ice seals in the Bering and Chukchi Seas and gray whales. Since June 1, 2018, elevated strandings for bearded, ringed and spotted seals have occurred in the Bering and Chukchi seas in Alaska, with causes undetermined. Through 2020, there were 315 recorded seal strandings. For more information, please visit: *www.fisheries.noaa.gov/alaska/marine-life-distress/2018-2020-ice-seal-unusual-mortality-event-alaska*.

Since January 1, 2019, elevated gray whale strandings have occurred along the west coast of North America from Mexico through Alaska. As of April 5, 2021, there have been a total of 430 whales reported in the event, with approximately 205 dead whales in Mexico, 209 whales in the United States (including 93 in Alaska), and 16 whales in British Columbia, Canada. For the United States, the historical 18-year 5-month average (Jan–May) is 14.8 whales for this same time-period. Several dead whales have been emaciated with moderate to heavy whale lice (cyamid) loads. Necropsies have been conducted on a subset of whales with additional findings of vessel strike in three whales and entanglement in one whale. In Mexico, 50-55 percent of the free-ranging whales observed in the lagoons in winter have been reported as "skinny" compared to the annual average of 10-12 percent "skinny" whales normally seen. The cause of the UME is as yet undetermined. For more information, please visit: *www.fisheries.noaa.gov/national/marine-life-distress/2019-2020-gray-whale-unusual-mortality-event-along-west-coast-and*.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.,* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency cetaceans).

Subsequently, NMFS' 2018 Revision to its *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (Technical Guidance) (NMFS, 2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.,* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 2.

Table 2. Marine Mammal Hearing Groups (NMFS, 2018)

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

* Represents the generalized hearing range for the entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.,* 2007) and PW pinniped (approximation).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al*., 2006; Kastelein *et al*., 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Thirteen marine mammal species (9 cetacean and 4 pinniped (all phocid) species) have the reasonable potential to co-occur

with the proposed survey activities. Please refer to Table 1. Of the cetacean species that may be present, 5 are classified as low-frequency cetaceans (*i.e.*, all mysticete species), 3 are classified as mid-frequency cetaceans (*i.e.*, all delphinid species), and 1 is classified as high-frequency cetacean (*i.e.*, harbor porpoise).

Potential Effects of Specified Activities on Marine Mammals and their Habitat

This section includes a summary of the ways that UAGI's specified activity may impact marine mammals and their habitat. Detailed descriptions of the potential effects of similar specified activities have been provided in other recent **Federal Register** notices, including for survey activities using the same methodology and over a similar amount of time, and affecting similar species (*e.g.*, 83 FR 29212, June 22, 2018; 84 FR 14200, April 9, 2019; 85 FR 19580, April 7, 2020). No significant new information is available, and we refer the reader to these documents for additional detail. The **Estimated Take** section includes a quantitative analysis of the number of individuals that are expected to be taken by UAGI's activity. The **Negligible Impact Analysis and Determination** section considers the potential effects of the specified activity, the **Estimated Take** section, and the **Proposed Mitigation** section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Background on Active Acoustic Sound Sources and Acoustic Terminology

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to the discussion of the effects of the specified activity on marine mammals in this document. For general information on sound and its interaction with the marine environment, please see, *e.g.*, Au and Hastings (2008); Richardson *et al*. (1995); Urick (1983).

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the "loudness" of a sound and is typically described using the relative unit of the decibel. A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)), and is a logarithmic unit that accounts for large variations in amplitude. Therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.*, 100 percent of the acoustic energy). SEL is a cumulative

metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source and is represented in the same units as the rms sound pressure.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for sound produced by the pile driving activity considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al*., 1995). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.*, vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and

possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly.

The sum of the various natural and anthropogenic sound sources that comprise ambient sound at any given location and time depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson *et al*., 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward, 1997 in Southall *et al*., 2007). Please see Southall *et*

al. (2007) for an in-depth discussion of these concepts. The distinction between these two sound types is not always obvious, as certain signals share properties of both pulsed and non-pulsed sounds. A signal near a source could be categorized as a pulse, but due to propagation effects as it moves farther from the source, the signal duration becomes longer (*e.g.*, Greene and Richardson, 1988).

Pulsed sound sources (*e.g.*, airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.*, rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Airgun arrays produce pulsed signals with energy in a frequency range from about 10-2,000 Hz, with most energy radiated at frequencies below 200 Hz. The amplitude of the acoustic wave emitted from the source is equal in all directions (*i.e.*, omnidirectional), but airgun arrays do possess some directionality due to different phase delays between guns in different directions. Airgun arrays are typically tuned to maximize functionality

for data acquisition purposes, meaning that sound transmitted in horizontal directions and at higher frequencies is minimized to the extent possible.

Summary on Specific Potential Effects of Acoustic Sound Sources

Underwater sound from active acoustic sources can include one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking. The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al*., 2007).

Animals in the vicinity of UAGI's proposed seismic survey activity are unlikely to incur PTS due to the small estimated auditory injury zones, in conjunction with the anticipated efficacy of the proposed mitigation requirements. Please see **Estimated Take** and **Proposed Mitigation** for further discussion.

Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors. Available studies show wide variation in

response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal.

In addition, sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.*, those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.*, snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.*, shipping, sonar, seismic exploration) in origin.

Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.*, crustaceans, cephalopods, fish, zooplankton) (*i.e.*, effects to marine mammal habitat). Prey species exposed to sound might move away from the sound source, experience TTS, experience masking of biologically relevant sounds, or show no obvious direct effects. The most likely impacts (if any) for most prey species in a given area would be temporary avoidance of the area. Surveys using active acoustic sound sources move through an area relatively quickly, limiting exposure to multiple pulses. In all cases, sound levels would return to ambient once a survey ends and the noise source is shut down and, when exposure to sound ends, behavioral and/or physiological responses are expected to end relatively quickly. Finally, the survey equipment will not have significant impacts to the seafloor and does not represent a source of pollution.

Vessel Strike

Vessel collisions with marine mammals, or ship strikes, can result in death or serious injury of the animal. These interactions are typically associated with large whales, which are less maneuverable than are smaller cetaceans or pinnipeds in relation to large vessels. The severity of injuries typically depends on the size and speed of the vessel,

with the probability of death or serious injury increasing as vessel speed increases (Knowlton and Kraus, 2001; Laist et al., 2001; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber et al., 2010; Gende et al., 2011). The chances of a lethal injury decline from approximately 80 percent at 15 kn to approximately 20 percent at 8.6 kn. At speeds below 11.8 kn, the chances of lethal injury drop below 50 percent (Vanderlaan and Taggart, 2007).

Ship strikes generally involve commercial shipping, which is much more common in both space and time than is geophysical survey activity and which typically involves larger vessels moving at faster speeds. Jensen and Silber (2004) summarized ship strikes of large whales worldwide from 1975-2003 and found that most collisions occurred in the open ocean and involved large vessels (*e.g.*, commercial shipping). Commercial fishing vessels were responsible for three percent of recorded collisions, while no such incidents were reported for geophysical survey vessels during that time period.

For vessels used in geophysical survey activities, vessel speed while towing gear is typically only 4-5 knots. At these speeds, both the possibility of striking a marine mammal and the possibility of a strike resulting in serious injury or mortality are so low as to be discountable. At average transit speed for geophysical survey vessels (approximately 10 kn), the probability of serious injury or mortality resulting from a strike (if it occurred) is less than 50 percent (Vanderlaan and Taggart, 2007; Conn and Silber, 2013). However, the likelihood of a strike actually happening is again low given the smaller size of these vessels and generally slower speeds. We anticipate that vessel collisions involving seismic data acquisition vessels towing gear, while not impossible, represent unlikely, unpredictable events for which there are no preventive measures. Given the required mitigation measures, the relatively slow speeds of vessels towing gear, the presence of bridge crew watching for obstacles at all times (including marine

mammals), the presence of marine mammal observers, and the small number of seismic survey cruises relative to commercial ship traffic, we believe that the possibility of ship strike is discountable and, further, that were a strike of a large whale to occur, it would be unlikely to result in serious injury or mortality. No incidental take resulting from ship strike is anticipated or proposed for authorization, and this potential effect of the specified activity will not be discussed further in the following analysis.

The potential effects of UAGI's specified survey activity are expected to be limited to Level B behavioral harassment. No permanent auditory effects, or significant impacts to marine mammal habitat, including prey, are expected.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of "small numbers" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines "harassment" as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would be by Level B harassment, as use of seismic airguns may result, either directly or as a result of TTS, in disruption of behavioral patterns of marine mammals. The proposed mitigation and monitoring measures are expected to minimize the severity of such taking to the extent practicable. Moreover, based on the nature of the activity and the anticipated effectiveness of the mitigation measures (*i.e.*, implementation of extended shutdown distances for certain species) – discussed in detail below in the

Proposed Mitigation section — Level A harassment is neither anticipated nor proposed to be authorized.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.*, frequency, predictability, duty cycle), the environment (*e.g.*, bathymetry), the receiving animals (hearing, motivation, experience, demography, behavioral context), and the distance between the sound source and the animal, and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.*, 2012). NMFS uses a generalized acoustic threshold based on

received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals may be behaviorally harassed (*i.e.*, Level B harassment) when exposed to underwater anthropogenic noise above received levels 160 dB re 1 μPa (rms) for the impulsive sources (*i.e.*, seismic airguns) evaluated here.

Level A harassment for non-explosive sources - NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). UAGI's proposed seismic survey includes the use of impulsive sources (seismic airgun).

These thresholds are provided in Table 3 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*.

Table 3. Thresholds Identifying the Onset of Permanent Threshold Shift

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	*Cell 2* $L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	*Cell 3* $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	*Cell 4* $L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	*Cell 5* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 6* $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 8* $L_{E,PW,24h}$: 201 dB

Otariid Pinnipeds (OW) (Underwater)	*Cell 9* $L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	*Cell 10* $L_{E,OW,24h}$: 219 dB

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of 1µPa^{2}s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.*, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and acoustic propagation modeling.

The acoustic propagation modeling methodologies are described in greater detail in Appendix A of UAGI's IHA application. The proposed survey would primarily acquire data using the 2-airgun array with a total discharge volume of 1,040 in^3 and an approximately 15-second shot interval. During approximately 12 percent of the planned survey tracklines, the 6-airgun, 3,120 in^3 array would be used with a 60-second shot interval. All tracklines would be surveyed with a maximum tow depth of 9 m. The modeling assumed an airgun firing pressure of 2,540 psi. Propagation modeling for UAGI's application follows the approach used by the Lamont-Doherty Earth Observatory (L-DEO) for other, similar IHA applications. L-DEO uses ray tracing for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite homogeneous ocean layer, unbounded by a seafloor). To validate the model results, L-DEO measured propagation of pulses from a 36-airgun array at a tow depth of 6 m in the

Gulf of Mexico, for deep water (~1,600 m), intermediate water depth on the slope (~600–1,100 m), and shallow water (~50 m) (Tolstoy *et al*., 2009; Diebold *et al*., 2010).

L-DEO collected a MCS data set from R/V *Marcus G. Langseth* (with the same 36-airgun array referenced above) on an 8 km streamer in 2012 on the shelf of the Cascadia Margin off of Washington in water up to 200 m deep that allowed Crone *et al*. (2014) to analyze the hydrophone streamer (>1,100 individual shots). These empirical data were then analyzed to determine in situ sound levels for shallow and upper intermediate water depths. These data suggest that modeled radii were 2–3 times larger than the measured radii in shallow water. Similarly, data collected by Crone *et al*. (2017) during a survey off New Jersey in 2014 and 2015 confirmed that in situ measurements collected by R/V *Langseth* hydrophone streamer were 2–3 times smaller than the predicted radii.

L-DEO model results are used to determine the assumed radial distance to the 160-dB rms threshold for these arrays in deep water (>1,000 m) (down to a maximum water depth of 2,000 m) (see Table 4). Water depths in the project area may be up to 4,000 m, but marine mammals in the region are generally not anticipated to dive below 2,000 m (Costa and Williams, 1999). The radii for intermediate water depths (100–1000 m) are derived from the deep-water ones by applying a correction factor (multiplication) of 1.5. No survey effort would occur in water depths < 100 m.

The area expected to be ensonified was determined by entering the planned survey lines into a GIS and then "buffering" the lines by the applicable 160-dB distance (see Appendix B in IHA application). The resulting ensonified areas were then increased by 25% to allow for any necessary additional operations, such as re-surveying segments where data quality was insufficient. This approach assumes that no marine mammals would move away or toward the trackline in response to increasing sound levels before the levels reach the threshold as R/V *Sikuliaq* approaches.

Table 4. Predicted Radial Distances to Isopleths Corresponding to Level B Harassment Threshold.

Source and volume	Tow depth (m)	Water depth (m)	Level B harassment zone (m)
6 airgun array; 3,120 in^3	9	> 1000	4,640[1]
		100 – 1000	6,960[3]
2 airgun array; 1,040 in^3	9	> 1000	1,604[1]
		100 – 1000	2,406[2]

[1]Distance based on L-DEO model results.

[2]Based on L-DEO model results with 1.5x correction factor applied.

Predicted distances to Level A harassment isopleths, which vary based on marine mammal hearing groups, were calculated based on L-DEO modeling performed using the NUCLEUS source modeling software program and the NMFS User Spreadsheet, described below. The acoustic thresholds for impulsive sounds (*e.g.*, airguns) contained in the Technical Guidance were presented as dual metric acoustic thresholds using both SEL_{cum} and peak sound pressure metrics (NMFS 2018). As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.*, metric resulting in the largest isopleth). The SEL_{cum} metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group. In recognition of the fact that the requirement to calculate Level A harassment ensonified areas could be more technically challenging to predict due to the duration component and the use of weighting functions in the new SEL_{cum} thresholds, NMFS developed an optional User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to facilitate the estimation of take numbers.

The values for SEL_{cum} and peak SPL were derived from calculating the modified far-field signature. The farfield signature is often used as a theoretical representation of the source level. To compute the farfield signature, the source level is estimated at a large distance below the array (*e.g.*, 9 km), and this level is back projected mathematically to a notional distance of 1 m from the array's geometrical center. However, when the source

is an array of multiple airguns separated in space, the source level from the theoretical farfield signature is not necessarily the best measurement of the source level that is physically achieved at the source (Tolstoy *et al.*, 2009). Near the source (at short ranges, distances <1 km), the pulses of sound pressure from each individual airgun in the source array do not stack constructively, as they do for the theoretical farfield signature. The pulses from the different airguns spread out in time such that the source levels observed or modeled are the result of the summation of pulses from a few airguns, not the full array (Tolstoy *et al.*, 2009). At larger distances, away from the source array center, sound pressure of all the airguns in the array stack coherently, but not within one time sample, resulting in smaller source levels (a few dB) than the source level derived from the farfield signature. Because the farfield signature does not take into account the large array effect near the source and is calculated as a point source, the modified farfield signature is a more appropriate measure of the sound source level for distributed sound sources, such as airgun arrays. The acoustic modeling methodology as used for estimating Level B harassment distances with a small grid step of 1 m in both the inline and depth directions. The propagation modeling takes into account all airgun interactions at short distances from the source, including interactions between subarrays, which are modeled using the NUCLEUS software to estimate the notional signature and MATLAB software to calculate the pressure signal at each mesh point of a grid.

In order to more realistically incorporate the Technical Guidance's weighting functions over the seismic array's full acoustic band, unweighted spectrum data (modeled in 1 Hz bands) were used to make adjustments (dB) to the unweighted spectrum levels, by frequency, according to the weighting functions for each relevant marine mammal hearing group. These adjusted/weighted spectrum levels were then converted to pressures (μPa) in order to integrate them over the entire broadband spectrum, resulting in broadband weighted source levels by hearing group that could be directly incorporated

within the User Spreadsheet (*i.e.*, to override the Spreadsheet's more simple weighting factor adjustment). Using the User Spreadsheet's "safe distance" methodology for mobile sources (described by Sivle *et al.*, 2014) with the hearing group-specific weighted source levels, and inputs assuming spherical spreading propagation and source velocities and shot intervals specific to the planned survey, potential radial distances to auditory injury zones were then calculated for SEL_{cum} thresholds. For full detail of the modeling methodology used for estimating distance to Level A harassment peak pressure and cumulative SEL criteria, please see Appendix A of UAGI's application.

Inputs to the User Spreadsheets in the form of estimated source levels are shown in Appendix A of UAGI's application. User Spreadsheets used by UAGI to estimate distances to Level A harassment isopleths for the airgun arrays are also provided in Appendix A of the application. Outputs from the User Spreadsheets in the form of estimated distances to Level A harassment isopleths for the survey are shown in Table 5. As described above, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the dual metrics (SEL_{cum} and Peak SPL_{flat}) is exceeded (*i.e.*, metric resulting in the largest isopleth).

Table 5. Modeled Radial Distances (m) to Isopleths Corresponding to Level A Harassment Thresholds

Source (volume)	Threshold	Level A harassment zone (m)			
		LF cetaceans	MF cetaceans	HF cetaceans	Phocids
6-airgun array (3,120 in^3)	SEL_{cum}	51	0	0	0
	Peak	30	7	212	34
2-airgun array (1,040 in^3)	SEL_{cum}	17	0	0	0
	Peak	10	3	73	2

Note that because of some of the assumptions included in the methods used (*e.g.*, stationary receiver with no vertical or horizontal movement in response to the acoustic source), isopleths produced may be overestimates to some degree, which will ultimately result in some degree of overestimation of Level A harassment. However, these tools offer the best way to predict appropriate isopleths when more sophisticated modeling

methods are not available. NMFS continues to develop ways to quantitatively refine these tools and will qualitatively address the output where appropriate. For mobile sources, such as the proposed seismic survey, the User Spreadsheet predicts the closest distance at which a stationary animal would not incur PTS if the sound source traveled by the animal in a straight line at a constant speed.

Auditory injury is unlikely to occur for mid-frequency and low-frequency cetaceans given very small modeled zones of injury for those species (all estimated zones less than 10 m for mid-frequency cetaceans, up to a maximum of 51 m for low-frequency cetaceans and 34 m for phocid pinnipeds), in context of distributed source dynamics. Similarly, for high-frequency cetaceans, the maximum modeled injury zone for the low-energy array (88 percent of survey effort) is 73 m and auditory injury would be unlikely to occur during use of that array. The source level of the array is a theoretical definition assuming a point source and measurement in the far-field of the source (MacGillivray, 2006). As described by Caldwell and Dragoset (2000), an array is not a point source, but one that spans a small area. In the far-field, individual elements in arrays will effectively work as one source because individual pressure peaks will have coalesced into one relatively broad pulse. The array can then be considered a "point source." For distances within the near-field, *i.e.*, approximately 2-3 times the array dimensions, pressure peaks from individual elements do not arrive simultaneously because the observation point is not equidistant from each element. The effect is destructive interference of the outputs of each element, so that peak pressures in the near-field will be significantly lower than the output of the largest individual element. Here, the estimated Level A harassment isopleth distances would in all cases (other than for high-frequency cetaceans) be expected to be within the near-field of the array where the definition of source level breaks down. Therefore, actual locations within this distance of the array center where the sound level exceeds relevant harassment criteria would not necessarily exist.

In consideration of the received sound levels in the near-field as described above, we expect the potential for Level A harassment of low- and mid-frequency cetaceans and phocid pinnipeds to be de minimis, even before the likely moderating effects of aversion and/or other compensatory behaviors (*e.g.*, Nachtigall *et al*., 2018) are considered. A similar conclusion may be drawn for high-frequency cetaceans relative to use of the low-energy airgun array. We do not believe that Level A harassment is a likely outcome for any low- or mid-frequency cetacean or phocid pinniped and do not propose to authorize any Level A harassment for these species. For high-frequency cetaceans, the larger estimated Level A harassment zone associated with the high-energy array would be present for only 12 percent of total survey effort, and given the expected rarity of occurrence for harbor porpoise, no incidents of Level A harassment are expected.

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. Density values are shown in Table 6.

Cetacean densities in the U.S. Arctic were published by Schick *et al*. (2017). This study used line-transect aerial survey data from ASAMM collected in the U.S. Chukchi and Beaufort seas from 2000-2016 and associated habitat covariates to estimate abundance monthly within 10 km x 10 km grid cells (equivalent to a density in units of individuals/100km^2). Estimates were produced for bowhead, gray, and beluga whales, as well as other baleen whales such as fin, humpback, and minke whales. The spatial extent of the model predictions differed by species, but for all species other than bowhead whale and beluga whale was further south than the planned location of the UAGI survey. In general, marine mammals are expected to be encountered more frequently to the south of the proposed survey location. Therefore, estimated take numbers produced through use of the density model products are expected to be a very conservative estimate. Previous

monitoring reports from recent Arctic surveys using the same research vessel saw a total of three humpback whales, 1 spotted seal, 4 unknown seals (Please see the following link for more detailed information on this monitoring report: *https://media.fisheries.noaa.gov/dam-migration/onr_arcticresearch_2018iha_monrep_opr1.pdf)*. Furthermore, based on tagged surveys from the summer and fall, bowhead whales migrate across the continental shelf of Alaska in the Beaufort Sea to the central Chukchi Sea in September and remain in this area for the fall (Quakenbush, Small & Citta, 2013). Only one whale was reported to travel north towards the proposed survey area. With this information in mind, NMFS believes that the proposed take numbers conservatively estimate the number of bowhead whales that will be encountered during the proposed activity.

For all species, except for beluga whales, UAGI extended the Schick *et al*. (2017) density values to calculate predictions for areas farther north. The spatial coverage of density estimates for bowhead whales extends northward to ~74□ °N, which overlaps with the southern-most survey lines by ~25 km. However, the majority of the survey lines do not overlap with spatial coverage of the Schick *et al*. (2017) density estimates, so the following method was used to produce a conservative estimate of average bowhead density farther north. The two northern-most rows of 10km x 10km grid cells (*ie*., northern 20 km of estimates) and the two additional cells overlapped by the southern-most survey lines were selected from the bowhead whale GIS raster files for August and September between 140°W and 165°W, the approximate east-west extent of the survey lines. Density estimates within those cells were then evaluated and cells east of ~157°W were excluded as they contained densities that were effectively zero which would reduce the calculated average. The mean of the remaining cells (west of 157°W) was then calculated.

The same process was used to calculate densities for gray whales, fin whales, humpback whales, and minke whales. However the northern survey coverage from Schick *et al*. (2017) for these species extends only to ~73°N. This meant that there was no overlap with any of the survey lines and no additional cells beyond the two northernmost rows (20km) were used in the calculations. The resulting density estimates were extremely small.

For beluga whales, the spatial coverage of the Schick *et al*. (2017) density estimates overlapped the full extent of the survey lines and associated ensonified areas. To calculate an average beluga whale density in areas that may be exposed above threshold levels, UAGI selected all grid cells from the August and September estimates that overlapped (wholly or partially) with estimated the 160 dB ensonified area around the planned tracklines and calculated the mean.

During ASAMM, sightings of pinnipeds were recorded when possible and the resulting data were used by Schick *et al*. (2017) to produce habitat-based estimates in the same manner as cetaceans. However, given ASAMM was designed for large whales, including typically being flown at altitudes above 304.8 feet (ft) ASL, and small pinniped sightings may not have been recorded as consistently, the Schick *et al* (2017) pinniped densities were not used in this analysis. Instead, bearded and ringed seal densities from NMFS's Biological Opinion for the Navy's Arctic Research Activities 2018-2021 were used (NMFS 2019b), which were based on habitat-based modeling by Kaschner *et al*. (2006) and Kaschner (2004).

Spotted and ribbon seals were not included in NMFS (2019b). Thus, spotted seal densities were estimated by multiplying the ringed seal density by the ratio of the estimated Chukchi Sea populations of the two species. The best estimate of the Alaskan population of spotted seals is 461,625 (Muto *et al*., 2020), and ~8% of the population (~37,000) is estimated to be present in the Chukchi Sea during the summer and fall (Rugh

et al., 1997). As the best estimate of the population of ringed seals in the Alaskan Chukchi Sea is ~208,000 animals (Bengtson *et al*., 2005), this resulted in a ratio of 0.18. Based on Hartin *et al*., (2013), four ribbon seal sightings were reported during vessel operations in the Chukchi Sea from 2006 through 2010, resulting in a density estimate of 0.0007/km^2.

Highly variable oceanographic and atmospheric conditions determine the distribution of sea ice in the Arctic, which heavily influences the species and number of marine mammals potentially present at these high latitudes. Thus, there is considerable year-to-year variation in the distribution and abundance of the marine mammal species in the survey area. For some species, the densities derived from past surveys may not be representative of the densities that would be encountered during the proposed seismic surveys. However, the approach used here is based on the best available data.

Table 6. Density values used for take analysis, calculated by UAGI.

Species	Density (individuals/km2)
Bowhead whale	0.0124
Gray whale	0
Fin whale	0
Humpback whale	0
Minke whale	0
Beluga whale	0.0255
Killer whale	Unknown
Narwhal	Unknown
Harbor porpoise	Unknown
Bearded seal	0.0332
Ribbon seal	0.0677
Ringed seal	0.376
Spotted seal	0.0007

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate. In order to estimate the number of marine mammals

predicted to be exposed to sound levels that would result in Level A or Level B harassment, radial distances from the airgun array to predicted isopleths corresponding to the Level A harassment and Level B harassment thresholds are calculated, as described above. Those radial distances are then used to calculate the area(s) around the airgun array predicted to be ensonified to sound levels that exceed the Level A and Level B harassment thresholds. The distance for the 160-dB threshold (based on L-DEO model results) was used to draw a buffer around every transect line in GIS to determine the total ensonified area in each depth category. Estimated incidents of exposure above Level A and Level B harassment criteria are presented in Table 7. As noted previously, UAGI has added 25 percent in the form of operational days, which is equivalent to adding 25 percent to the proposed line-kilometers to be surveyed. This accounts for the possibility that additional operational days are required, and is included in the estimates of actual exposures.

The number of individual marine mammals potentially exposed to airgun sounds with received levels ≥ 160 dB re 1 μPa_{rms} (Level B) was estimated following NSF's take calculation method by multiplying the estimated densities by the total area expected to be ensonified above the Level threshold. The total ensonified area was multiplied by 25 percent to account for any necessary additional operations, such as re-surveying segments where data quality was insufficient. This approach assumes that no marine mammals would move away or toward the trackline in response to increasing sound levels before the levels reach the threshold as R/V *Sikuliaq* approaches. This value was then multiplied by the estimated densities for each species to produce estimated Level B takes. Given the location of the survey being far north in the Arctic, we expect that the density values, and thus estimated take numbers, are conservative estimates of what is likely to be encountered during the survey.

Table 7. Estimated Taking by Level A and Level B Harassment, and Percentage of Population

Species	Stock[1]	Estimated Level B harassment	Estimated Level A harassment	Proposed Level B harassment	Proposed Level A harassment	Total take	Percent of stock[1]
Bowhead whale	Western Arctic	339	3	342	0	342	2.03%
Humpback whale[2]	WN Pacific	0	0	2	0	2	0.00%
Fin whale[2, 4]	NE Pacific	0	0	2	0	2	0.00%
Gray whale[2]	EN Pacific	0	0	2	0	2	0.00%
Minke whale[2, 4]	Alaska	0	0	2	0	2	0.00%
Beluga whale	Beaufort Sea	696	7	703	0	703	1.34%
	Eastern Chukchi						
Killer whale[2]	Alaska Resident	0	0	6	0	6	0.00%
Narwhal[3, 4]	Unidentified	0	0	2	0	2	n/a
Harbor porpoise[2, 4]	Bering Sea	0	0	2	0	2	0.00%
Bearded seal	Beringia	907	9	916	0	916	0.73%
Ringed seal	Arctic	10,268	105	10,373	0	10,373	6.05%
Spotted seal	Bering	19	0	19	0	19	0.00%
Ribbon seal	Unidentified	1849	19	1868	0	1868	1.01%

[1] In most cases, where multiple stocks are being affected, for the purposes of calculating the percentage of the stock impacted, the take is being analyzed as if all proposed takes occurred within each stock. Where necessary, additional discussion is provided in the "Small Numbers Analysis" section.
[2] UAGI requests authorization of gray whale, humpback whale, fin whale, minke whale, killer whale, and harbor porpoise take equivalent to exposure of one group (Clarke *et al*., 2016; Clarke *et al*., 2017; Clarke *et al*., 2018; Clarke *et al*., 2019).
[3] UAGI requests authorization of two takes of narwhals.
[4] As noted in Table 1, there is no estimate of abundance available for these species. See "Small Numbers Analysis" section for further discussion.

Although, gray whales, fin whales, humpback whales, minke whales, narwhals and harbor porpoises are not expected to occur this far north in the Arctic, we agree with NSF that there is possibility that the proposed activity might encounter these species and thus a conservative number of takes based on average group size from yearly Aerial Surveys of Arctic Marine Mammals (ASAMM) (Clark *et al*., 2016, 2017, 2018, 2019) has been proposed.

Proposed Mitigation

In order to issue an IHA under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to the activity, and other means of effecting the least practicable impact on the species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stock for taking for certain subsistence uses. NMFS

regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting the activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat, as well as subsistence uses. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and;

(2) The practicability of the measures for applicant implementation, which may consider such things as cost and impact on operations.

In order to satisfy the MMPA's least practicable adverse impact standard, NMFS has evaluated a suite of basic mitigation protocols for seismic surveys that are required regardless of the status of a stock. Additional or enhanced protections may be required for species whose stocks are in particularly poor health and/or are subject to some significant additional stressor that lessens that stock's ability to weather the effects of the specified activities without worsening its status. We reviewed seismic mitigation protocols required or recommended elsewhere (*e.g.*, HESS, 1999; DOC, 2013; IBAMA, 2018; Kyhn *et al*., 2011; JNCC, 2017; DEWHA, 2008; BOEM, 2016; DFO, 2008; GHFS, 2015; MMOA, 2016; Nowacek *et al*., 2013; Nowacek and Southall, 2016),

recommendations received during public comment periods for previous actions, and the available scientific literature. We also considered recommendations given in a number of review articles (*e.g.*, Weir and Dolman, 2007; Compton *et al*., 2008; Parsons *et al*., 2009; Wright and Cosentino, 2015; Stone, 2015b). This exhaustive review and consideration of public comments regarding previous, similar activities has led to development of the protocols included here.

Due to the use of high- and low-energy airgun arrays used within this survey, two separate mitigation protocols are proposed for use throughout the activity depending on which array is in use (Table 8).

Vessel-Based Visual Mitigation Monitoring

Visual monitoring requires the use of trained observers (herein referred to as visual Protected Species Observers (PSOs)) to scan the ocean surface for the presence of marine mammals. The area to be scanned visually includes primarily the EZ, within which observation of certain marine mammals requires shutdown of the acoustic source, but also a buffer zone. The buffer zone means an area beyond the EZ to be monitored for the presence of marine mammals that may enter the EZ. During pre-clearance monitoring (*i.e.*, before ramp-up begins), the buffer zone also acts as an extension of the EZ in that observations of marine mammals within the buffer zone would also prevent airgun operations from beginning (*i.e.*, ramp-up). The standard EZ is 500 m from the edges of the airgun array for high energy surveys and 100 m for low energy surveys. For high energy surveys, the buffer zone encompasses the area at and below the sea surface from the edge of the 0–500 m EZ, out to a radius of 1,000 m from the edges of the airgun array (500–1,000 m). For low energy surveys, the buffer zone encompasses the area at and below the sea surface from the edge of the 0–100 m EZ, out to a radius of 200 m from the edges of the airgun array (100–200 m).

Visual monitoring of the EZ and buffer zones is intended to establish and, when visual conditions allow, maintain zones around the sound source that are clear of marine mammals, thereby reducing or eliminating the potential for injury and minimizing the potential for more severe behavioral reactions for animals occurring closer to the vessel. Visual monitoring of the buffer zone is intended to (1) provide additional protection to naïve marine mammals that may be in the area during pre-clearance, and (2) during airgun use, aid in establishing and maintaining the EZ by alerting the visual observer and crew of marine mammals that are outside of, but may approach and enter, the EZ.

UAGI must use dedicated, trained, NMFS-approved PSOs. The PSOs must have no tasks other than to conduct observational effort, record observational data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements. PSO resumes shall be provided to NMFS for approval.

At least one of the visual PSOs aboard the vessel must have a minimum of 90 days at-sea experience working in the roles, with no more than 18 months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience shall be designated as the lead for the entire protected species observation team. The lead PSO shall serve as primary point of contact for the vessel operator and ensure all PSO requirements per the IHA are met. To the maximum extent practicable, the experienced PSOs should be scheduled to be on duty with those PSOs with appropriate training but who have not yet gained relevant experience.

During survey operations (*e.g.*, any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two visual PSOs must be on duty and conducting visual observations at all times during daylight hours (*i.e.*, from 30 minutes prior to sunrise through 30 minutes following sunset). Visual monitoring of the EZ and buffer zone must begin no

less than 30 minutes prior to ramp-up and must continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset. Visual PSOs shall coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and shall conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.

PSOs shall establish and monitor the EZ and buffer zone. These zones shall be based upon the radial distance from the edges of the acoustic source (rather than being based on the center of the array or around the vessel itself). During use of the acoustic source (*i.e.*, anytime airguns are active, including ramp-up), detections of marine mammals within the buffer zone (but outside the EZ) shall be communicated to the operator to prepare for the potential shutdown of the acoustic source.

During use of the airgun (*i.e.*, anytime the acoustic source is active, including ramp-up), detections of marine mammals within the buffer zone (but outside the EZ) should be communicated to the operator to prepare for the potential shutdown of the acoustic source. Visual PSOs will immediately communicate all observations to the on duty acoustic PSO(s), including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination. Any observations of marine mammals by crew members shall be relayed to the PSO team. During good conditions (*e.g.*, daylight hours; Beaufort sea state (BSS) 3 or less), visual PSOs shall conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.

Visual PSOs may be on watch for a maximum of four consecutive hours followed by a break of at least one hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (visual and

acoustic but not at same time) may not exceed 12 hours per 24-hour period for any individual PSO.

Establishment of Exclusion and Buffer Zones

An EZ is a defined area within which occurrence of a marine mammal triggers mitigation action intended to reduce the potential for certain outcomes, *e.g.,* auditory injury, disruption of behavioral patterns. The PSOs would establish a minimum EZ with a 500- or 100-m radius, during use of the high energy and low energy arrays, respectively, for all species except bowhead whales. The EZ would be based on radial distance from the edge of the airgun array (rather than being based on the center of the array or around the vessel itself).

The EZs are intended to be precautionary in the sense that they would be expected to contain sound exceeding the injury criteria for all cetacean hearing groups, (based on the dual criteria of SEL_{cum} and peak SPL), while also providing a consistent, reasonably observable zone within which PSOs would typically be able to conduct effective observational effort. Additionally, the EZs are expected to minimize the likelihood that marine mammals will be exposed to levels likely to result in more severe behavioral responses. Although significantly greater distances may be observed from an elevated platform under good conditions, we believe that these distances are likely regularly attainable for PSOs using the naked eye during typical conditions.

An extended EZ of 1,500/500 m must be implemented for all bowhead whales during high energy and low energy survey effort, respectively, because of their importance to subsistence hunters and protected status. No buffer of this extended EZ is required.

Pre-clearance and Ramp-up

Ramp-up (sometimes referred to as "soft start") means the gradual and systematic increase of emitted sound levels from an airgun array. Ramp-up begins by first activating

a single airgun of the smallest volume, followed by doubling the number of active elements in stages until the full complement of an array's airguns are active. Each stage should be approximately the same duration, and the total duration should not be less than approximately 20 minutes for high energy airgun arrays. Ramp-up for the low energy array, which includes only two elements, may be shorter. The intent of pre-clearance observation (30 minutes) is to ensure no protected species are observed within the buffer zone prior to the beginning of ramp-up. During pre-clearance is the only time observations of protected species in the buffer zone would prevent operations (*i.e.*, the beginning of ramp-up). The intent of ramp-up is to warn protected species of pending seismic operations and to allow sufficient time for those animals to leave the immediate vicinity. A ramp-up procedure, involving a step-wise increase in the number of airguns firing and total array volume until all operational airguns are activated and the full volume is achieved, is required at all times as part of the activation of the acoustic source. All operators must adhere to the following pre-clearance and ramp-up requirements:

- The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up in order to allow the PSOs time to monitor the EZ and buffer zone for 30 minutes prior to the initiation of ramp-up (pre-clearance);
- Ramp-ups shall be scheduled so as to minimize the time spent with the source activated prior to reaching the designated run-in;
- One of the PSOs conducting pre-clearance observations must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed;
- Ramp-up may not be initiated if any marine mammal is within the applicable EZ or buffer zone. If a marine mammal is observed within the applicable EZ or the buffer zone during the 30 minute pre-clearance period, ramp-up may not begin

until the animal(s) has been observed exiting the zones or until an additional time period has elapsed with no further sightings (15 minutes for small odontocetes and pinnipeds, and 30 minutes for all mysticetes and all other odontocetes, including large delphinids, such as beluga whales and killer whales);

- Ramp-up shall begin by activating a single airgun of the smallest volume in the array and shall continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration. Duration shall not be less than 20 minutes for high energy arrays. The operator must provide information to the PSO documenting that appropriate procedures were followed;
- PSOs must monitor the relevant EZ and buffer zone during ramp-up, and ramp-up must cease and the source must be shut down upon detection of a marine mammal within the applicable EZ. Once ramp-up has begun, detections of marine mammals within the buffer zone do not require shutdown, but such observation shall be communicated to the operator to prepare for the potential shutdown;
- Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at times of poor visibility where operational planning cannot reasonably avoid such circumstances;
- If the acoustic source is shut down for brief periods (*i.e.*, less than 30 minutes) for reasons other than that described for shutdown (*e.g.*, mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual or acoustic detections of marine mammals have occurred within the applicable EZ. For any longer shutdown, pre-clearance observation and ramp-up are required. For any shutdown at night or in periods of poor visibility (*e.g.*, BSS 4 or greater), ramp-up is required, but if the shutdown period was brief and constant observation was maintained, pre-clearance watch of 30 minutes is not required; and

- Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require pre-clearance of 30 min.

Shutdown

The shutdown of an airgun array requires the immediate de-activation of all individual airgun elements of the array. Any PSO on duty will have the authority to delay the start of survey operations or to call for shutdown of the acoustic source if a marine mammal is detected within the applicable EZ. The operator must also establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the acoustic source to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch. When the airgun array is active (*i.e.*, anytime one or more airguns is active, including during ramp-up) and a marine mammal appears within or enters the applicable EZ, the acoustic source will be shut down. When shutdown is called for by a PSO, the acoustic source will be immediately deactivated and any dispute resolved only following deactivation.

Following a shutdown, airgun activity would not resume until the marine mammal has cleared the EZ. The animal would be considered to have cleared the EZ if it is visually observed to have departed the EZ, or it has not been seen within the EZ for 15 min in the case of small odontocetes and pinnipeds, or 30 min in the case of mysticetes and large odontocetes, including beluga whales and killer whales.

Upon implementation of shutdown, the source may be reactivated after the marine mammal(s) has been observed exiting the applicable EZ (*i.e.*, animal is not required to fully exit the buffer zone where applicable) or following 15 minutes for small odontocetes and pinnipeds, and 30 minutes for mysticetes and all other odontocetes, including beluga whales and killer whales, with no further observation of the marine mammal(s).

UAGI must implement shutdown if a marine mammal species for which take was not authorized, or a species for which authorization was granted but the takes have been met, approaches the Level A or Level B harassment zones. L-DEO must also implement shutdown if any of the following are observed at any distance:

- Any large whale (defined as any mysticete species) with a calf (defined as an animal less than two-thirds the body size of an adult observed to be in close association with an adult); and/or
- An aggregation of six or more large whales.

Passive Acoustic Monitoring (PAM)

NMFS does not propose to require use of PAM for this activity. NMFS typically recommends use of PAM as part of prescribed mitigation requirements for high energy surveys, but not for low energy surveys, which here comprise approximately 88 percent of the planned survey. Therefore, PAM would only be applicable to the small portion of the proposed survey (12 percent) using the high-energy array. In addition, use of towed PAM is not generally expected to be effective in detecting mysticetes, due to overlap in the frequencies of mysticete vocalizations with the noise from the airgun array as well as from the vessel itself and flow noise around the towed PAM receiver. Species of greatest interest in prescribing use of towed PAM (*e.g.*, sperm whales, beaked whales) are not present in the planned survey area. Further, UAGI has indicated that it would not be practicable to carry the additional monitoring personnel required for implementation of towed PAM. The R/V *Sikuliaq* is a smaller research vessel with limited space.

Table 8. Proposed mitigation protocols for high- and low-energy arrays.

Mitigation Protocols		
Sources	High Energy (6-airgun array with 3120 in^3 total discharge volume)	Low Energy (2-airgun array with 1040 in^3 total discharge volume)
Visual PSOs	Minimum of 2 NMFS-approved PSOs on duty during daylight hours (30	Minimum of 2 NMFS-approved PSOs on duty during daylight hours (30

	minutes before sunrise through 30 minutes after sunset); Limit of 2 consecutive hours on watch followed by a break of at least 1 hour; Maximum of 12 hours on watch per 24-hour period	minutes before sunrise through 30 minutes after sunset); Limit of 2 consecutive hours on watch followed by a break of at least 1 hour; Maximum of 12 hours on watch per 24-hour period
Passive acoustic monitoring	Not Required	Not required
Exclusion zones	• 500 m (all marine mammals) • 1,500 m (Bowhead whales)	• 100 m (all marine mammals) • 500 m (Bowhead whales)
Pre-start clearance	Required; 30-minute clearance period of the following zones: • 1,000 m (all marine mammals) • 1,500 m (Bowhead whales) Following detection within zone, animal must be observed exiting or additional period of 15 or 30 minutes	Required; 30-minute clearance period of the following zones: • 200 m (all marine mammals) • 500 m (Bowhead whales) Following detection within zone, animal must be observed exiting or additional period of 15 or 30 minutes
Ramp-up	Required; duration ≥ 20 minutes	Required; duration not more than 20 minutes
Shutdown	Shutdown required for marine mammal detected within defined EZs; Re-start allowed following clearance period of 15 or 30 minutes	Shutdown required for marine mammal detected within defined EZs; Re-start allowed following clearance period of 15 or 30 minutes

Vessel Strike Avoidance

1. Vessel operators and crews must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (distances stated below). Visual observers monitoring the vessel strike avoidance zone may be third-party observers (*i.e.*, PSOs) or crew members, but crew members responsible for these duties must be provided sufficient training to 1) distinguish marine

mammals from other phenomena, and 2) broadly identify a marine mammal as a bowhead whale, other whale (defined in this context as baleen whales other than bowhead whales), or other marine mammal.

2. Vessel speeds must also be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near a vessel.

3. All vessels must maintain a minimum separation distance of 500 m from bowhead whales. If a whale is observed but cannot be confirmed as a species other than a bowhead whale, the vessel operator must assume that it is a bowhead whale and take appropriate action.

4. All vessels must maintain a minimum separation distance of 100 m from all other baleen whales.

5. All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all other marine mammals, with an understanding that at times this may not be possible (*e.g.*, for animals that approach the vessel).

6. When marine mammals are sighted while a vessel is underway, the vessel shall take action as necessary to avoid violating the relevant separation distance (*e.g.*, attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If protected species are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This does not apply to any vessel towing gear or any vessel that is navigationally constrained.

7. These requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of the restriction, cannot comply.

We did not identify any mitigation specifically appropriate for habitat. Marine mammal habitat may be impacted by elevated sound levels, but these impacts would be temporary. Prey species are mobile and are broadly distributed throughout the project area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. The specified activity is if relatively short duration (30 days) and the disturbance will be temporary in nature, similar habitat and resources are available in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. No BIAs, designated critical habitat, or other habitat of known significance would be impacted by the planned activities.

We have carefully evaluated the suite of mitigation measures described here and considered a range of other measures in the context of ensuring that we prescribe the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of the proposed measures, as well as other measures considered by NMFS described above, NMFS has preliminarily determined that the mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses (see **Unmitigable Adverse Impact Analysis and Determination)**.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that

requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.*, presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Vessel-based Visual Monitoring

As described above, PSO observations would take place during daytime airgun operations. During seismic operations, at least five visual PSOs would be based aboard the R/V *Sikuliaq*. Two visual PSOs would be on duty at all time during daytime hours. Monitoring shall be conducted in accordance with the following requirements:

- The operator shall provide PSOs with bigeye binoculars (*e.g.*, 25 x 150; 2.7 view angle; individual ocular focus; height control) of appropriate quality (*i.e.*, Fujinon or equivalent) solely for PSO use. These shall be pedestal-mounted on the deck at the most appropriate vantage point that provides for optimal sea surface observation, PSO safety, and safe operation of the vessel; and
- The operator will work with the selected third-party observer provider to ensure PSOs have all equipment (including backup equipment) needed to adequately perform necessary tasks, including accurate determination of distance and bearing to observed marine mammals.

PSOs must have the following requirements and qualifications:

- PSOs shall be independent, dedicated, trained visual and acoustic PSOs and must be employed by a third-party observer provider;
- PSOs shall have no tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards);
- PSOs shall have successfully completed an approved PSO training course;
- NMFS must review and approve PSO resumes accompanied by a relevant training course information packet that includes the name and qualifications (*i.e.*, experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material as well as a document stating successful completion of the course;

- NMFS shall have one week to approve PSOs from the time that the necessary information is submitted, after which PSOs meeting the minimum requirements shall automatically be considered approved;
- PSOs must successfully complete relevant training, including completion of all required coursework and passing (80 percent or greater) a written and/or oral examination developed for the training program;
- PSOs must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences, a minimum of 30 semester hours or equivalent in the biological sciences, and at least one undergraduate course in math or statistics; and
- The educational requirements may be waived if the PSO has acquired the relevant skills through alternate experience. Requests for such a waiver shall be submitted to NMFS and must include written justification. Requests shall be granted or denied (with justification) by NMFS within one week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to (1) secondary education and/or experience comparable to PSO duties; (2) previous work experience conducting academic, commercial, or government-sponsored protected species surveys; or (3) previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties. Traditional ecological knowledge is also a relevant consideration.

For data collection purposes, PSOs shall use standardized data collection forms, whether hard copy or electronic. PSOs shall record detailed information about any implementation of mitigation requirements, including the distance of animals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent

ramp-up of the acoustic source. If required mitigation was not implemented, PSOs should record a description of the circumstances. At a minimum, the following information must be recorded:

- Vessel names (source vessel and other vessels associated with survey) and call signs;
- PSO names and affiliations;
- Dates of departures and returns to port with port name;
- Date and participants of PSO briefings;
- Dates and times (Greenwich Mean Time) of survey effort and times corresponding with PSO effort;
- Vessel location (latitude/longitude) when survey effort began and ended and vessel location at beginning and end of visual PSO duty shifts;
- Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any line change;
- Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions changed significantly), including BSS and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon;
- Factors that may have contributed to impaired observations during each PSO shift change or as needed as environmental conditions changed (*e.g.*, vessel traffic, equipment malfunctions); and
- Survey activity information, such as acoustic source power output while in operation, number and volume of airguns operating in the array, tow depth of the array, and any other notes of significance (*i.e.*, pre-clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, etc.).

The following information should be recorded upon visual observation of any protected species:

- Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
- PSO who sighted the animal;
- Time of sighting;
- Vessel location at time of sighting;
- Water depth;
- Direction of vessel's travel (compass direction);
- Direction of animal's travel relative to the vessel;
- Pace of the animal;
- Estimated distance to the animal and its heading relative to vessel at initial sighting;
- Identification of the animal (*e.g.*, genus/species, lowest possible taxonomic level, or unidentified) and the composition of the group if there is a mix of species;
- Estimated number of animals (high/low/best);
- Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);
- Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- Detailed behavior observations (*e.g.*, number of blows/breaths, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);

- Animal's closest point of approach (CPA) and/or closest distance from any element of the acoustic source;
- Platform activity at time of sighting (*e.g.*, deploying, recovering, testing, shooting, data acquisition, other); and
- Description of any actions implemented in response to the sighting (*e.g.*, delays, shutdown, ramp-up) and time and location of the action.

Reporting

A report would be submitted to NMFS within 90 days after the end of the cruise. The report would describe the operations that were conducted and sightings of marine mammals near the operations. The report would provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report would summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities).

The draft report shall also include geo-referenced time-stamped vessel tracklines for all time periods during which airguns were operating. Tracklines should include points recording any change in airgun status (*e.g.*, when the airguns began operating, when they were turned off, or when they changed from full array to single gun or vice versa). GIS files shall be provided in ESRI shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates shall be referenced to the WGS84 geographic coordinate system. In addition to the report, all raw observational data shall be made available to NMFS. The report must summarize the data collected as described above and in the IHA. A final report must be submitted within 30 days following resolution of any comments on the draft report.

Reporting Injured or Dead Marine Mammals

Discovery of injured or dead marine mammals – In the event that personnel involved in survey activities covered by the authorization discover an injured or dead

marine mammal, the UAGI shall report the incident to the Office of Protected Resources (OPR), NMFS and to the NMFS Alaska Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behaviors of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and
- General circumstances under which the animal was discovered.

Vessel strike – In the event of a ship strike of a marine mammal by any vessel involved in the activities covered by the authorization, UAGI shall report the incident to OPR, NMFS and to the NMFS Alaska Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Vessel's speed during and leading up to the incident;
- Vessel's course/heading and what operations were being conducted (if applicable);
- Status of all sound sources in use;
- Description of avoidance measures/requirements that were in place at the time of the strike and what additional measure were taken, if any, to avoid strike;
- Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;
- Species identification (if known) or description of the animal(s) involved;
- Estimated size and length of the animal that was struck;
- Description of the behavior of the animal immediately preceding and

following the strike;

- If available, description of the presence and behavior of any other marine mammals present immediately preceding the strike;
- Estimated fate of the animal (*e.g.*, dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and
- To the extent practicable, photographs or video footage of the animal(s).

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, our analysis applies to all species listed in Table 1, given that NMFS expects the anticipated effects of the planned geophysical survey to be similar in

nature. Where there are meaningful differences between species or stocks, or groups of species, in anticipated individual responses to activities, impact of expected take on the population due to differences in population status, or impacts on habitat, NMFS has identified species-specific factors to inform the analysis.

NMFS does not anticipate that injury, serious injury or mortality would occur as a result of UAGI's planned survey, even in the absence of mitigation, and none would be authorized. Similarly, non-auditory physical effects, stranding, and vessel strike are not expected to occur. Although a few incidents of Level A harassment were predicted through the quantitative exposure estimation process (see **Estimated Take**), NMFS has determined that this is not a realistic result due to the small estimated Level A harassment zones for the species (no greater than approximately 50 m) and the proposed mitigation requirements, and no Level A harassment is proposed for authorization. These estimated zones are larger than what would realistically occur, as discussed in the Estimated Take section. Although no Level A harassment would be expected to occur even absent mitigation, the extended distance exclusion zones proposed for bowhead whales further strengthen this conclusion.

We expect that takes would be in the form of short-term Level B behavioral harassment in the form of temporary avoidance of the area or decreased foraging (if such activity were occurring), reactions that are considered to be of low severity and with no lasting biological consequences (*e.g.*, Southall *et al.*, 2007, Ellison *et al*., 2012). The proposed number of takes for bowhead whales is 2 percent of the population. We expect this number to be even smaller as the likelihood of encountering these animals in deep waters in the Northern Arctic Ocean are slim based on recent telemetry data (Quakenbush, Small & Citta, 2013).

Marine mammal habitat may be impacted by elevated sound levels, but these impacts would be temporary. Prey species are mobile and are broadly distributed

throughout the project area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the relatively short duration (30 days) and temporary nature of the disturbance, the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. No BIAs, designated critical habitat, or other habitat of known significance would be impacted by the planned activities.

Negligible Impact Conclusions

The proposed survey would be of short duration (30 days of seismic operations), and the acoustic "footprint" of the proposed survey would be small relative to the ranges of the marine mammals that would potentially be affected. Sound levels would increase in the marine environment in a relatively small area surrounding the vessel compared to the range of the marine mammals within the proposed survey area. Short term exposures to survey operations are expected to only temporarily affect marine mammal behavior in the form of avoidance, and the potential for longer-term avoidance of important areas is limited. Short term exposures to survey operations are not likely to impact marine mammal behavior, and the potential for longer-term avoidance of important areas is limited.

The proposed mitigation measures are expected to reduce the number and/or severity of takes by allowing for detection of marine mammals in the vicinity of the vessel by visual observers, and by minimizing the severity of any potential exposures via shutdowns of the airgun array.

NMFS concludes that exposures to marine mammal species and stocks due to UAGI's proposed survey would result in only short-term (temporary and short in

duration) effects to individuals exposed, over relatively small areas of the affected animals' ranges. Animals may temporarily avoid the immediate area, but are not expected to permanently abandon the area. Major shifts in habitat use, distribution, or foraging success are not expected. NMFS does not anticipate the proposed take estimates to impact annual rates of recruitment or survival.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No Level A harassment, serious injury or mortality is anticipated or proposed to be authorized;
- The proposed activity is temporary and of relatively short duration (30 days);
- The anticipated impacts of the proposed activity on marine mammals would primarily be temporary behavioral changes in the form of avoidance of the area around the survey vessel;
- Location of the survey is further north in the Arctic Ocean and away from areas where most of the species listed in Table 1 have been observed and is north of summer feeding areas and migratory routes.
- The availability of alternate areas of similar habitat value for marine mammals to temporarily vacate the survey area during the proposed survey to avoid exposure to sounds from the activity;
- The potential adverse effects on fish or invertebrate species that serve as prey species for marine mammals from the proposed survey would be temporary and spatially limited, and impacts to marine mammal foraging would be minimal; and

- The proposed mitigation measures, including visual monitoring, shutdowns, ramp-up, and prescribed measures based on energy size are expected to minimize potential impacts to marine mammals (both amount and severity).

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether the take is limited to small numbers of marine mammals. When the predicted number of individuals to be taken is fewer than one third of the species or stock abundance, the take is considered to be of small numbers (see 86 Federal Register 5322, 5439 (January 19, 2021). Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

There are several stocks for which there is no currently accepted stock abundance estimate. These include the fin whale, minke whale, narwhal, bearded seal, and ringed seal. In those cases, qualitative factors are used to inform an assessment of whether the likely number of individual marine mammals taken is appropriately considered small. We discuss these in further detail below.

For all other stocks (aside from those without accepted abundance estimates), the proposed take is less than 7% of the best available stock abundance, well less than the

one-third threshold for exceeding small numbers (and some of those takes may be repeats of the same individual, thus rendering the actual percentage even lower). We also acknowledge that, given the location of the planned survey activity high in the Arctic Ocean, the stock ranges referenced in the SARs do not always fully overlap the area of the planned survey activity. However, given the very small percentage of the best available stock abundance estimates for these species and the likelihood that the numbers of take proposed for authorization would be very small relative to any reasonable population abundance estimate, we conclude these numbers are small.

The stock abundance estimates for fin whale, minke whale, narwhal, bearded seal and ringed seal stocks that occur in the surveys area are unknown, according to the latest SARs. Therefore, we reviewed other scientific information in making our small numbers determinations for these animals. The abundance estimate of 20,000 minke whales was taken from the Northwest Pacific and Okhotsk Sea (IWC 2021). In addition, as noted previously, partial abundance estimates of 1,233 and 2,020 minke whales are available for shelf and nearshore waters between the Kenai Peninsula and Amchitka Pass and for the eastern Bering Sea shelf, respectively. For the minke whale, these partial abundance estimates alone are sufficient to demonstrate that the proposed take number of 2 is of small numbers. The same surveys produced partial abundance estimates of 1,652 and 1,061 fin whales, for the same areas, respectively, which are similarly sufficient to demonstrate that the proposed take number of 2 is small numbers. The bearded seal estimate of 125,000 was estimated for the U.S. portion of the Bering Sea (Boveng *et al*., 2017) and 155,000 bearded seals for the entire Alaska stock (Cameron *et al*., 2010). These partial abundance estimates near the proposed survey are sufficient to demonstrate that the proposed take number of 916 seals is small numbers. Similarly, the ringed seal abundance estimate of 171,418 ringed seals was based on a limited sub-sample from the Bering Sea (Conn *et al*., 2014 in Muto *et al*., 2020). This minimal abundance estimate for

the Alaska region is enough to demonstrate that a take of 10,373 will be small numbers at 6.05% of the Bering Sea population. There is no abundance information available for narwhals. However, the take number is sufficiently small (2) that we assume that it is small relative to any reasonable assumption of likely population abundance for the narwhal. Additionally, the proposed survey area encompasses a very small portion of the hypothesized range of the species.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

In order to issue an IHA, NMFS must find that the specified activity will not have an "unmitigable adverse impact" on the subsistence uses of the affected marine mammal species or stocks by Alaskan Natives. NMFS has defined "unmitigable adverse impact" in 50 CFR 216.103 as an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The coast and nearshore waters of Alaska are of cultural importance to indigenous peoples for fishing, hunting, gathering, and ceremonial purposes. Marine mammals are legally hunted in Alaskan waters by coastal Alaska Natives. There are seven communities in the North Slope Borough region of Alaska (northwestern and northern Alaska) that harvest seals, including from west to east Point Hope, Point Lay, Wainwright, Utqiaġvik,

Atqusak, Nuiqsut, and Kaktovik (Ice Seal Committee 2019). Bearded seals are the preferred species to harvest as food and for skin boat coverings, but ringed seals are also commonly taken for food and their blubber (Ice Seal Committee 2019). Ringed seals are typically harvested during the summer and can extend up to 64 km from shore (Stephen R. Braund & Associates 2010). No ribbon seals have been harvested in any of the North Slope Borough communities since the 1960s (Ice Seal Committee 2019). However, the number of seals harvested each year varies considerably.

A subsistence harvest of bowheads and belugas is also practiced by Alaskan Natives, providing nutritional and cultural needs. In 2019, 36 bowhead whales were taken during the Alaskan subsistence hunt (Suydam *et al*., 2020). Whaling near Utqiaġvik occurs during spring (April and May) and autumn, and can continue into November, depending on the quota and conditions. Communities that harvested bowheads during 2019 include Utqiaġvik, Gamgell, Kaktovik, Nuiqsut, Point Hope, Point Lay, and Wainwright. Bowhead whales and gray whales are also taken in the aboriginal subsistence hunt in the Russian Federation (Zharikov *et al*., 2020). During 2019, 135 gray whales and one bowhead whale were harvested at Chukotka.

Beluga whales from the eastern Chukchi Sea stock are an important subsistence resource for residents of the village of Point Lay, adjacent to Kasegaluk Lagoon, and other villages in northwest Alaska. Each year, hunters from Point Lay drive belugas into the lagoon to a traditional hunting location. The belugas have been predictably sighted near the lagoon from late June through mid to late July (Suydam *et al*., 2001). The mean annual number of Beaufort Sea belugas landed by Alaska Native subsistence hunters in 2011– 2015 was 47, and an average of 92 were taken in Canadian waters; the mean annual number of Eastern Chukchi Sea belugas landed by Alaska Native subsistence hunters in 2011–2015 was 67 (Muto *et al*., 2020).

The proposed survey by UAGI will occur within ~73.5-81.0 °N, ~139.5-168 °W and over 300 km from the Alaska coastline. Due to the location of the survey being far north in the Arctic and over 200 kilometers from any hunting area or buffer (*http://www.north-slope.org/assets/images/uploads/bowhead%20migration%20map%2021mar03%20distribution.pdf*), no impacts on the availability of marine mammals for subsistence uses are expected to occur. Specifically, based on the survey methods and location proposed, there is no reason to believe that there will be any behavioral disturbance of bowhead whales that would also impact their behavior in a manner that would interfere with subsistence use later. Although fishing/hunting would not be precluded in the survey area, a safe distance would need to be kept from R/V *Sikuliaq* and the towed seismic equipment. The principal investigator for the survey has presented the proposed action to the Alaska Eskimo Whaling Commission (AEWC) at the July 2020, October 2020, and February 2021 Triannual Meetings. As specifically noted, during the meetings, daily email communications with interested community members would be made from the vessel. Communication may include notice of any unusual marine mammal observations during the survey. Any potential space use conflicts would be further avoided through direct communication with subsistence fishers/hunters during the surveys. Considering the limited time that the planned seismic surveys would take place and the far offshore location of the surveys, no direct interaction with subsistence fishers/hunters would be anticipated. However, UAGI will still be required to remain in constant communication with subsistence fishers/hunters during the surveys.

Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the proposed mitigation and monitoring measures, NMFS has preliminarily

determined that there will not be an unmitigable adverse impact on subsistence uses from UAGI's proposed activities.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq*.) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally whenever we propose to authorize take for endangered or threatened species.

NMFS is proposing to authorize take of bowhead whales, fin whales, bearded seals and ringed seals, which are listed under the ESA.

OPR Permits and Conservation Division has requested initiation of Section 7 consultation with the OPR Endangered Species Act Interagency Cooperation Division for the issuance of this IHA. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to UAGI for conducting geophysical surveys in the Arctic in August and September, 2021, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*.

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this notice of proposed IHA for the proposed geophysical surveys. We also request at this time comment on the potential Renewal of this proposed IHA as described

in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent renewal IHA.

On a case-by-case basis, NMFS may issue a one-time, one-year renewal IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical or nearly identical, or nearly identical, activities as described in the **Description of Proposed Activity** section of this notice is planned or (2) the activities as described in the **Description of Proposed Activity** section of this notice would not be completed by the time the IHA expires and a renewal would allow for completion of the activities beyond that described in the *Dates and Duration* section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to the needed renewal IHA effective date (recognizing that the renewal IHA expiration date cannot extend beyond one year from expiration of the initial IHA).
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the requested renewal IHA are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.*, reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more

than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: May 25, 2021.

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